

Big Sagebrush Shrub-steppe Postfire Succession in Southwest Montana

Prepared for:

United States Department of the Interior
Bureau of Land Management
Dillon Field Office

By:

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Dillon, Montana 59725

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EXECUTIVE SUMMARY

Sagebrush steppe is the dominant vegetation type in southwest Montana, and fire played a large role in structuring these ecosystems. However, we have little knowledge of how vegetation changes with time as succession proceeds from immediate post-fire to mature stands. Species such as sage grouse, antelope, pygmy rabbits and Brewer's sparrow depend on sagebrush. Management activities change the composition and structure of vegetation in these communities, so comprehensive management of sagebrush at the landscape scale cannot be accomplished without understanding how these attributes change with time since disturbance. The purpose of this study was to document how sagebrush communities change with age in southern Beaverhead and adjacent Madison counties.

We sampled at 38 sites dominated by *Artemisia tridentata* ssp. *wyomingensis*, ssp. *vaseyana* or ssp. *tridentata*. Time since fire varied from 3 to 34 years among sites. At each site we subjectively located one sample plot representing the burned area and a control macroplot in similar, adjacent, unburned vegetation. Canopy cover of shrubs was estimated using the line-intercept method, and cover of bare ground, litter and all herbaceous species were estimated in ten microplots. Plants of all shrubs were classified into four size classes and counted in these microplots. Density was recorded for each species in the Cichorieae tribe of the Asteraceae in each microplot. Age and height of one randomly chosen sagebrush plant in each size class were determined from five microplots, and age was determined by counting annual growth rings. Soil samples were collected at each site and analyzed for percent organic matter, sand, silt and clay. We analyzed data with paired-sample t-tests, regression analysis and analysis of variance.

Regression models indicated that average post-fire time to full recovery of ssp. *vaseyana* canopy was 32 years, shorter for ssp. *tridentata* and much longer for ssp. *wyomingensis*. Height of the dominant sagebrush cohort recovered at similar rates with 100% recovery projected to be ca. 33 years for ssp. *vaseyana*. There was no difference in canopy or height recovery between prescribed

fires and wildfires in stands of ssp. *vaseyana*. We found no relationship between sagebrush canopy recovery and annual precipitation, heat load or soil texture. We found no support for a relationship between grazing regime and sagebrush canopy recovery rate or that proximity to a seed source promotes faster recovery. Our results suggest that the majority of presettlement ssp. *vaseyana* stands would have been in early to mid-seral condition if we assume a mean fire interval of 25 years and a mean full recovery time of 32 years. Nearly all unburned control sagebrush macroplots were uneven-aged, indicating that recruitment was not limited to immediate post-fire conditions in any of the subspecies.

Average canopy cover of *Artemisia tripartita* did not increase following fire, and only 15% of plants survived the Winslow Fire of 2003. Age-class distributions indicate that many *A. tripartita* plants established from seed instead of sprouting following fire. Average density of the guild of subdominant shrubs, *Chrysothamnus nauseosus*, *C. viscidiflorus* and *Tetradymia canescens*, doubled after fire, although there were no statistically significant increases for any of the species taken alone.

Perennial graminoid cover was greater in burned than unburned control macroplots in stands dominated by *A. tridentata* ssp. *vaseyana*, and this difference was driven by changes in *Agropyron spicatum* rather than *Festuca idahoensis*. On average grass cover in burned *A. tridentata* ssp. *vaseyana* macroplots returned to control levels within 30 years after fire. Perennial grass cover averaged 13% higher in burned macroplots following prescribed fire but only 4% higher following wildfire.

Fire-induced changes in the canopy cover of forbs were small; there was only a marginally significant tendency for forb cover to be higher in burned macroplots compared to controls. The proportional change in forb cover following fire at sites dominated by *A. tridentata* ssp. *vaseyana* did not differ between prescribed fires and wildfires.

There was no evidence for a change in the abundance of forbs in the Cichorieae Tribe of the Asteraceae, important foods for sage grouse brood rearing.

The results of our study have implications for management. Proper identification of sagebrush subspecies is an important precursor to any management activity because canopy cover of ssp. *vaseyana* stands will require an average of 32 years to recover, but those of ssp. *wyomingensis* may require a century or more. Many sagebrush steppe species may require a mosaic of stand ages; maintaining a mosaic of approximately half late-seral and half early-seral stands of ssp. *vaseyana*

will require imposing a fire-return interval of about 50-80 years on all stands in the landscape. Only long fire-return intervals will allow stands dominated by ssp. *wyomingensis* to remain on the landscape in our study area. Managers cannot assume that stands of ssp. *vaseyana* on more mesic sites will recover faster or that sagebrush canopy will recover faster following prescribed fire compared to wildfire. Prescribed fire resulted in an average increase of 13% in grass canopy cover, so followed by light grazing, it may be a way of rejuvenating ssp. *vaseyana* stands. Prescribed fire or wildfire will induce only a small increase in the cover of forbs overall, and will have no effect on the abundance of plants in the Cichorieae.

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